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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/526,513
Filing Date: March 04, 2005
Appellant(s): SOLF ET AL.

Chris M.Ries

For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 14, 2008 appealing from the Office action mailed May 15, 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

U.S. Pat. Pub. No. 2002/0049375	Strommer et al	Sep. 7, 2001
US 5, 951,475	Gueziec et al.	Sep. 25, 1997

(9) Grounds of Rejection

Claims 1-10, 12 and 14 are unpatentable under 35 U.S.C. § 103 (a) over U.S. Pat Pub. No. (2002/0049375) to Strommer et al. (hereinafter "Strommer") in view of U.S.Pat.No 5,951,475 to Guerziec et al (hereinafter "Guerziec").

Regarding Claim 1: As to claim 1, Strommer teaches a method of optimizing a two-dimensional image of a body volume which contains an object, in which the method comprising: acquiring a first two-dimensional image of the body volume with the object in the body volume (note that two dimensional image acquisition device 104 detects a plurality of two dimensional images of the inspected organ through image transducer 118, paragraph [0150], 104, figure 1); acquiring a three-dimensional representation of feasible locations of the object within the body volume(digital 3D image reconstruction, 112, figure 1 detects the three dimensional location and orientation of the image detector using MPS sensor 162, paragraph [0033-0034]), determining a current position of the object in the body volume based on the first two dimensional image (note that in processor 236, each detected two-dimensional image is associated with the location and orientation information thereof and the organ timing signal at the time the two dimensional image was taken, paragraph [0152], detecting real time image, 836, figure 22) ; associating the current position of the object with the three-dimensional representation (see paragraph [0238-0239]); determining imaging parameters which are optimum in respect of the position of the object based on the three-dimensional representation (see paragraph [0153-154]), note that figure 3 is the visualization of the orientation and location of the 2D image); and controlling movement of an imaging system based on the imaging parameters (see paragraph [0123-0127]);

and generating a second two-dimensional image of the body volume based on the optimum imaging parameters (838,840, figure 22).While Strommer meets a number of the limitations of the claimed invention, as pointed out more fully above, Strommer fails to teach the generation of the image as being a two dimensional image he generates more a three dimensional representation with respect to the location and orientation using a two dimensional image acquisition. Specifically, Gueziec et al. teaches registering two dimensional fluoroscopic images with a three dimensional model of a surgical tissue of interest. The method includes steps of: (a) generating, from CT or MRI data, a three dimensional model of a surgical tissue of interest; (b) obtaining at least two, two dimensional, preferably fluoroscopic, x-ray images representing at least two views of the surgical tissue of interest, the images containing radio-opaque markers for associating an image coordinate system with a surgical (robot) coordinate system; (c) detecting the presence of contours of the surgical tissue of interest in each of the at least two views; (d) deriving bundles of three dimensional lines that pass through the detected contours; and (e) interactively matching three dimensional points on three dimensional silhouette curves obtained from the three dimensional model with the bundles of three dimensional lines until the three dimensional model is registered within the surgical coordinate system to a predetermined level of accuracy. The step of iteratively matching includes steps of: defining a distance between surfaces of the model and a beam of three dimensional lines that approach the surfaces; and finding a pose of the surfaces that minimizes a distance to the lines using, preferably, a statistically robust method, thereby providing a desired registration between a surgical robot and a preoperative treatment plan. .it would have been obvious to one of ordinary skill in the art to generate a second 2 D image of the body volume in Strommer et al.step 246 in order to readily visually

determine on the 2-D projection whether the registration is accurate, whereas a 3-D view can be useful for providing three dimensional spatial relationships. Therefore, the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention by applicant.

Regarding Claim 2: Strommer et al teaches a method as claimed in claim 1, wherein the two-dimensional image is a projection of the body volume which has been generated by means of X-rays (Two-dimensional image acquisition device 104 can be of any type known in the art, such as ultra-sound, inner-vascular ultra-sound, X-ray, see paragraph [0101]) and wherein the second two-dimensional image is generated without using external markers for comparing images (The pair of closely spaced transducers define a line which calculates the tangent to the curve defined by the catheter imaging tip at that point. The tangent is calculated by the line defined by the two or more points determined by the location of the tracking transducers [paragraph [0022])

Regarding Claim 3: claim 3 differ from claim 1 only in that claim 1 is a method claim whereas; claim 3 is imaging system that carries out the method of claim 1. Thus, claim 3 is analyzed as previously discussed with respect to claim 1 above.

Regarding Claim 4: Strommer et al teaches an imaging system as claimed in claim 3, wherein it includes further comprising an X-ray apparatus with an X-ray source and a detector which are attached to a movable C-arm, wherein the second two-dimensional image is generated without using external markers for comparing images (see figures 1, and paragraph [0093], note that the detection id performed by a medical monitoring device which is selected according to the inspected organ, note that the surgical tool moves paragraph [0124])).

Regarding Claim 5: Strommer teaches an imaging system as claimed in claim 4, wherein the X-ray apparatus includes adjustable diaphragms whose adjustment forms part of the imaging parameters optimized by the data processing unit (modifying at least one of the two dimensional images by discarding a portion thereof which represents the surgical tool, 240, figure 6).

Regarding Claims 6 and 7: Gueziec teaches an imaging system as claimed in claim 3, wherein the imaging parameters comprises at least one of a sectional plane of an image and a projection direction (see figures 3 and 4).

Regarding Claims 8 and 9: As to claims 8 and 9, Gueziec teaches an imaging system as claimed in claim 3, wherein the feasible locations of the object are vessels within a biological body volume, and that the data processing unit is arranged to define the optimum imaging parameters causing the segment of the vascular tree in which the object to be projected essentially in a planar fashion in the two-dimensional image (FIG. 1A, the calibration rod 12 is positioned along two ruled surfaces that are referred to as the "near plane" and the "far plane". In this description it is assumed that such surfaces are planar, but the method is not restricted to planes. The "near plane" is the plane closer to the x-ray source 14A and further away from the x-ray detector (image intensifier 14B) than the far plane)

Regarding Claim 10: Gueziec teaches an imaging system as claimed in claim 3, wherein it includes a device for the formation of images and is arranged to display the two-dimensional image in superposed form together with an image formed from the three-dimensional representation with completely the same or partly the same imaging parameters (The effect is

that the image of the beads forms a calibration grid that is superimposed on the x-ray image data that is output from the image intensifier 14B to the data processor 16, figure 1B,1C), the image formed from the three-dimensional representation preferably reproducing an area which is larger than that reproduced by the two-dimensional image (The area is then determined by computing first the areas of the triangles formed with the origin and a polygon segment and by summing such areas. Once the polygonal curves defining the markers have been extracted the method retains the (x, y) coordinate on the marker in the image. These coordinates are measured in the image coordinate system with respect to an image origin, note that the three-dimensional coordinate is greater than the two dimensional image, note that the superimposition of 3-D models on 2-D images helps in achieving realistic texture mapping to the models, see also Strommer et al figure 22).

Regarding Claims 12 and 14: Strommer teaches the method of claim 1, further comprising generating the second two- dimensional image without using back projection of the first two-dimensional image (super imposing a representation of the surgical tool onto the selected three dimensional image, figure 6, 246; note that Strommer et al does not teach the back projection but uses the superimposing process to generate the image.)

(10) Response to Argument

Appellant, at part B, on page 4, brief, argues that Strommer do not disclose feasible locations of the object within the body volume and Strommer does not describe detecting the

feasible locations (plural) of the image detector using the MPC sensor but rather the single actual location and orientation of the image detector.

In response: appellant argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e.: detecting the feasible locations (plural) of the image detector) are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Therefore, the claim does not require the feasible locations of the image detector but rather the feasible location of the object (i.e. organ). Strommer teaches the organ and determine EACH location and orientation. Strommer further detects plurality of detectors location and orientation (see column 3, paragraph [0033-0034]).

Strommer States:

The method further includes the procedures of associating each of the two-dimensional images with the image detector location and orientation and with the detected organ timing signal, and reconstructing a plurality of three-dimensional images from the two-dimensional images. The method further includes the procedures of selecting one of the three-dimensional images according to a real-time reading of the organ timing signal, and displaying the selected three-dimensional image.

By all means, each image orientation and location is associated with a detector orientation and location (i.e. plurality of images, plurality of locations). Therefore, it can not be a single actual location it has to be a plurality of images locations as well as image detector locations as shown in figure 1.

Appellant, at part C, on page 5, brief, argues that Strommer do not disclose associating the current position of the object with the three dimensional representation and that Strommer clearly refers to associating two dimensional image rather than three dimensional image.

In response,

In response, it is true that Strommer teaches associating a projection of two dimensional images with the location and orientation of the object but Strommer also states:

> *Processor 460 superimposes a projection 754 of reconstructed three-dimensional image 736 on real-time two-dimensional navigation image 758, which is acquired by real-time imaging system 484, thereby producing the combined two-dimensional image presented in window 734. Processor 460 further superimposes representation 756 of surgical tool 486 on real-time two-dimensional navigation image 758. Representation 756 indicates the current location and orientation of surgical tool 486 within descending aorta 744. Processor 460 selects projection 754, in real-time according to a real-time detected activity-state of the heart of patient 462 and hence follows the visual activity of real-time two-dimensional navigation image 758.*
>
> *It is noted that the location of real-time imaging system 484 relative to the origin of the global coordinate system is determined either according to a fixed predetermined location relative to transmitter 458, or according to an MPS sensor coupled to real-time imaging system 484.*

Therefore, Strommer clearly teaches associating the current position of the object using both projection of reconstructed 2D and 3D image which reads on the claim which requires associating the current position (i.e. real time) with the three dimensional representation. When the processor 460 superimposes a projection of the reconstructed 3D image on real time two dimensional navigation images and associated it with the location of real time (i.e. current position) relative to the origin of global coordinate (see paragraph [0238-0239]) .

Appellant, at part D, on page 6, brief, argues that Strommer do not disclose controlling movement of an imaging system based on the imaging parameters and that the movement described by Strommer is not "based on the imaging parameters."

In response, Strommer teaches controlling the movement of the surgical tool.

Strommer states:

Display 130 presents a three-dimensional motion picture of the inspected organ in synchrony therewith, which can be considered a pseudo real-time simulation thereof. It is noted that main computer 102 can determine the display reference coordinate system to be any of the following:

The coordinate system of the patient, where the body of the patient is still and the inspected organ and the surgical tool, move.

The coordinate system of the inspected organ, where the inspected organ is still, and surgical tool and the rest of body of the patient, move. It is noted that this viewing coordinate system can be extremely useful in cases where the inspected organ exhibits rapid movement.

The coordinate system of the surgical tool, where the surgical tool is still, and the inspected organ as well as the rest of the body of the patient, move.

Therefore, the surgical tool is moved based on the movement of the patient or the movement of the inspected organ which are the imaging parameters. The computer 102 (figure 1) will synchronize the movement (see paragraph [0122-0126]).

Claim 3 is the system that performs the method steps of claim 1; therefore, arguments for claim 3 are analogous to those stated for claim 1

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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